

# Technical Report

## Aquatic Management Indicator Species

Paul Cowley  
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### Monitoring Approach

Bonneville and Colorado River cutthroat trout were selected as management indicators for aquatic habitats. Appendix B3 of the Final Environmental Impact Statement for Wasatch-Cache National Forest Plan Revision (February, 2003, Tables B-3-6 through B-3-16) contains extensive information on cutthroat trout populations based on surveys conducted by the Utah Division of Wildlife Resources and the Forest Service from 1993 through 2001 across the Forest. A total of ten drainages were found to support cutthroat trout populations (Table 1).

Table 1. Drainages on the Wasatch-Cache National Forest that contain populations of cutthroat trout with information tables identifying more specific population information.

<b>Bonneville cutthroat trout</b>	
<b>Drainage</b>	<b>Population info. FEIS Appendix B</b>
Upper Bear River	Table B-3-10, pg. B3-48-49
North Cache Valley	Table B-3-10, pg. B3-52
South Cache Valley	Table B-3-12, pg. B3-54-56
Weber River	Table B-3-13, pg. B3-59
Ogden River	Table B-3-14, pg. B3-61-63
Salt Lake County (Jordan River)	Untitled Table, pg. B3-66
Provo River	Table B-3-15, pg. B3-64
<b>Colorado River cutthroat trout</b>	
<b>Drainage</b>	<b>Population info. FEIS Appendix B</b>
Henrys Fork	Table B-3-6, pg. B3-42
Blacks Fork	Table B-3-7, pg. B3-44
Muddy Creek	Table B-3-8, pg. B3-46

The Upper Bear River on the Evanston Ranger District was surveyed in 2003. The relevant portions of the Forest Plan FEIS Table B-3-10 has been copied into this document as Table 2.

A population is a reproducing and recruiting group of individuals that are geographically or biologically isolated. For cutthroat trout, fish biologists often refer to metapopulations. Metapopulations are collections of localized populations that are geographically distinct yet are genetically interconnected through natural movement of individuals among populations. Metapopulations have a greater chance for long-term persistence and recolonization after natural or man-caused disturbances than isolated populations. Historically most populations were part of a larger metapopulation.

The following factors were considered in the selected monitoring approach:

- Each stream has a limited production capacity. Changes in production from habitat alteration may be seen in either a shift in number of fish or the

Table 2 (Wasatch-Cache National Forest 2003 FEIS B3-10). Risks and threats associated with the Upper Bear River Drainage (HUC-14040107) on the Wasatch-Cache National Forest with the identified trend.

Subwatershed and 6 Field HUC Number	Landscape Condition GI,WQ,WV	Temporal Variability	Population Size	Growth and Survival	Isolation	Overall Extinction Risk	Roads, Trails, Motorized Trails (%)	Developed & Special Use (%)	Grazing Head-months (cow/sheep)	Non-native	Trend
East Fork Bear River 160101010101	2,2,1	2 Some disturbance in drainage	2 limited metapopulation, non-natives	1 limited influence	2 good connectivity	3	0.432246	0.014046	285/751	Rainbow brook	Flat
Stillwater Drainage 160101010102	2,2,1	1 Mostly in wilderness	1 large metapopulation 322 fish/mile, 4 miles of stream	1 habitat excellent	1 good connectivity	1	0.426281	1.147866	011080	Rainbow	Flat
Hayden Fork 160101010103	3,2,1	2 less stable conditions	1 large metapopulation	3 tie hacking impacts	2 fewer main river individuals	3 population is Hayden Fork is limited	0.431153	1.832368	0/678	Rainbow Brook	Down
West Fork Bear River, Meadow, Humpy, Deer C 160101010104	3,2,3	2 Dam natural hydrograph disrupted	1 large population 1562 fish/mile)	2 dam and alteration	2 some restriction in access between populations	2	0.590703	0.000000	0/6095	Rainbow brook	Flat
Lower Part near Guard Station 160101010105	2,2,2	1 relatively stable	3 potentially connected to metapopulations seasonally	3 water temperature, diversions, road impacts	1 good connectivity	3	1.905344	9.799349	01295	Rainbow	Down
Lower Part of Bear River 160101010106	Non-Forest	0 private lands	0 private land	0 private lands	0 private lands	0 private lands	0.000000	0.000000	0/0	Rainbow brook	0 private lands
Mill Creek Drainage 160101010201	3,2,2	1 good stability	2 low population number 85-50 fish/mile	3 tie hacking and road impacts	1 good connectivity	2	0.826135	0.439950	911740	None	Flat

size/condition of the fish or there may be no change in either factor. For example: a drainage producing enough nutrients to sustain **50, 2** pound fish, should support 100, 1 pound fish. However, a 12 inch fish that weighs one pound is quite different than a 12 inch long fish **weighing** a half a pound. Length and weight, as well as total number of individuals are important sampling factors. To take this into account, we look at total fish biomass being produced and the size/condition of the fish collected. Species composition is also a concern and is monitored to gauge the long-term health of cutthroat trout populations.

- We have a large number of populations and some metapopulations across the Forest. A single stream may actually contain more than one population. These populations may form part of a metapopulation or may be isolated **from** each other. Populations can be isolated by physical barriers like dams and culverts **and/or** by biological barriers such as water temperature.
- Changes in one population may or may not be reflected in another population in an adjacent drainage.
- It is not economically feasible to survey all of the streams on the Forest each year.
- A number of streams contain non-native fish. This probably affects the number and potential size of native cutthroat found in **annual** monitoring.

Surveys for cutthroat trout on the forest are designed to allow for monitoring of population trends taking the above factors into account. We collect information on population numbers, fish conditions and fish biomass as well as species composition. The approach consists of extensively surveying one drainage area (**4<sup>th</sup>** level hydrologic unit code (HUC)) each year. This provides a snapshot of the entire **HUC** at one time and builds on what we have been doing over the past 10 years in collecting baseline data. The approach allows for the comparison over time of results for the full HUC, or for what is happening in individual stream sections surveyed. Over a ten-year period (about two full generations of fish) all of the **HUCs** will be surveyed to provide a Forestwide perspective of changes in fish populations and species composition for trends.

## Monitoring Results

In the first year of the Revised Forest Plan implementation, the Wasatch-Cache National Forest conducted fish surveys in the headwater tributaries of the Bear River Drainage (Figure 1, Table 3). These surveys repeated surveys conducted initially in **1994 to** monitor Bonneville cutthroat trout and forest management activities. Some additional streams were surveyed in 2003 to provide a more comprehensive look at the area. The data collected during the summer of **2003** is compared with data collected during 1994 (**Cowley** 1995, Table 3). There are also a number of ongoing activities that have or are planned in the drainage. These include the East Fork Fire monitoring, the East Fork Fire Salvage and the West Fork Bear River Timber Sale and salvage. The State of Utah, Division of Wildlife Resources, also conducted fish surveys on private lands downstream of the Forest (Figure 1) and on the lower **mainstem** streams on the Forest in a few locations.

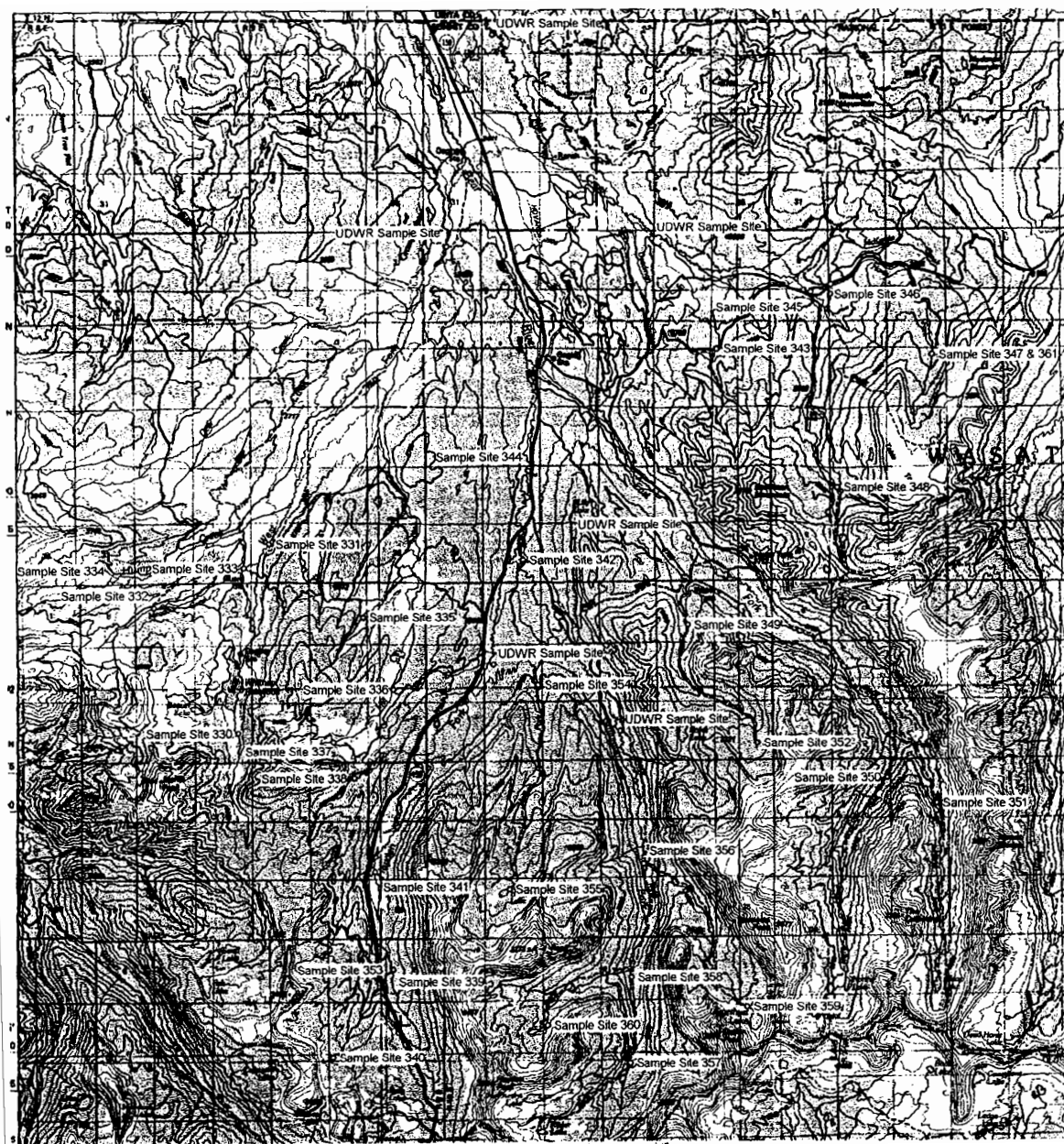


Figure 1. Map of fish sampling locations in the upper Bear River Drainage located in Summit County, Utah, 2003. Forest Service sample sites are identified by "Sample Site ##". UDWR sample sites are also identified.

Table 3. Stream specific information regarding individual populations with identified drainages

Subwatershed and 6 <sup>th</sup> Field HUC Number	Stream	Survey Site	Fish Species	1994 salmonids per mile	2003 salmonids per mile	1994 Biomass (lb/acre)	2003 Biomass (lb/acre)	1994 Ave. Condition Index	2003 Ave. Condition Index	Comments	Trend
East Fork Bear River 160101010101	E.F. Bear Right Hand Fork	350	cutthroat	nd	201	nd	24	nd	1.00	New sample, in wilderness	Believed Flat
	E.F. Bear, <del>Left</del> Hand Fork	351	cutthroat	nd	876	nd	34	nd	1.07	New sample, in wilderness	Believed Flat
	Boundary Creek Lower	349	rainbow	16	0	4	0	0.81	0		Down
		349	brook	113	97	10	23	1.20	1.01		Down
		349	cutthroat	116	131	27	16	0.96	0.90		Flat
		349	total	245	228	41	39	na	na	Fire burned over the area in 2002. Lower end of drainage burned over.	Down
	Boundary Creek Upper	352	brook	16	No fish	98	0	1.39	0	Over wintering/stocking survival in Baker Lake major influence.	Down
Stillwater Drainage 160101010102	Stillwater Fork Lower <sup>(1)</sup>	342	rainbow	172	10	7	0	0.97	0	Rainbow stocking was stopped for 2001-2002	Down
		342	brook	116	16	7	0	0.90	1.18		Down
		342	cutthroat	32	32	7	2	0.92	0.94		Flat
		342	whitefish	0	64	0	5	0	0.95		Up Flat
		342	total	320	122	21	7	na	na		
	Stillwater Fork Middle	358	cutthroat	379	503	14	21	.88	0.93	In Wilderness	Up
	Stillwater Fork Upper	357	cutthroat	nd	604	nd	35	nd	0.98	New sample, in Wilderness	Believed Flat

Subwatershed and 6 <sup>th</sup> Field HUC Number	Stream	Survey Site	Fish Species	1994 salmonids per mile	2003 salmonids per mile	1994 Biomass (lb/acre)	2003 Biomass (lb/acre)	1994 Ave. Condition Index	2003 Ave. Condition Index	Comments	Trend
	Ostler Fork Lower	356	brook	97	589	14	26	1.11	0.92		Up
		356	cutthroat	241	145	15	5	.95	1.00		
		356	total	338	734	29	31	na	na		
	Ostler									Amethyst Lake	
	Upper	359	brook	463	371	46	63	1.06	1.09		
		359	cutthroat	64	0	6	0	1.04	0	Reflects fish just below Amethyst Lake	Down
		359	total	527	371	52	63	na	na	Reflects fish just below Amethyst Lake. Downstream barrier prevents upstream migration.	Flat
	West Basin	360	brook	0	588	0	26	0	1.16	Reflects fish just below Kermisuh Lake.	Up
		360	cutthroat	present	664	nd	53	0.89	.95	Reflects fish just below Kermisuh Lake.	Believed Flat
		360	total trout	nd	695	nd	79	na	na	Reflects fish just below Kermisuh Lake.	Believed Flat
	Main Fork Lower	354	cutthroat	209	145	11	8	0.91	1.10		down
	Main Fork Upper	355	cutthroat	209	201	43	49	0.78	1.04	Reflects fish just below Hell Hole Lake	Flat
Hayden Fork 160101010103	Gold Hill Creek	338	cutthroat	cutthroat only	32	nd	41	nd	1.36		Believed Flat
	Hayden Fork Upper	339	brook	present	217	nd	7	nd	1.06		Believed Flat
		339	cutthroat	present	10	nd	<1	nd	0.94		Believed Flat
		339	whitefish	present	16	nd	1	nd	1.05		Believed Flat

Subwatershed and 6 <sup>th</sup> Field HUC Number	Stream	Survey Site	Fish Species	1994 salmonids per mile	2003 salmonids per mile	1994 Biomass (lb/acre)	2003 Biomass (lb/acre)	1994 Ave. Condition Index	2003 Ave. Condition Index	Comments	Trend
		339	total	nd	242	nd	8	na	na		Believed Flat
	Hayden Fork at Whisky Creek	341	brook	495	302	19	19	1.03	1.10		Flat
		341	cutthroat	32	64	3	7	0.82	0.97		Up
		341	rainbow	64	64	6	7	0.94	1.03		Up
		341	whitefish	16	32	4	7	1.00	0.97		Up
		341	total	607	462	32	40	na	na		Up
	Teal Lake Trib. Lower	353	brook	present	161	1	4	0.90	0.71		Flat
		353	cutthroat	present	16	28	35	0.96	1.04		Up
		353	total	nd	177	29	39	na	na		Flat
	Teal Lake Trib. Upper	340	brook	present	348	6	39	0.76	1.17		Up
		340	cutthroat	present	64	2	23	0.93	.76		Flat
		340	total	nd	412	8	62	na	na		Flat
West Fork Bear River, Meadow, Humpy, Deer C 160101010104	West Fork Bear Lower	331	brook	0	16	0	3	0	1.45	Could have come from Whitney Reservoir or moved up the West Fork Bear River.	Up
		331	cutthroat		243	33	19	.99	1.04	Probably reflects flows out of Whitney Reservoir	Down
		331			259	33	22	na	na	Probably reflects flows out of Whitney Reservoir	Down
	West Fork Bear Upper	330	brook	0	16	0	19	0	0.91	Moved up out of Whitney Reservoir	Up

Subwatershed and 6 <sup>th</sup> Field HUC Number	Stream	Survey Site	Fish Species	1994 salmonids per mile	2003 salmonids per mile	1994 Biomass (lb/acre)	2003 Biomass (lb/acre)	1994 Ave. Condition Index	2003 Ave. Condition Index	Comments	Trend
		330	cutthroat	48	158	48	146	0.91	0.94		Up
		330	rainbow	0	163	0	290	0	0.91	Moved up out of Whitney Reservoir	Up
		330	total	48	337	48	455	na	na		Up
	Meadow Creek Upper	332	cutthroat	nd	172	nd	22	nd	1.13	New sample	Believed Flat
	Meadow Creek Lower	333	cutthroat	nd	197	nd	37	nd	1.00	New sample	Believed Flat
	Humpy Creek	334	cutthroat	nd	80	nd	28	nd	.96	New sample	Believed Flat
	Coyote Hollow	335	cutthroat	nd	64	nd	60	nd	1.08	New sample	Believed Flat
	Mill City Creek Lower	336	no fish	0	0	0	0	0	0		na
	Mill City Creek Upper	337	cutthroat	nd	209	nd	108	nd	1.08		Believed Flat
Lower Part near Guard Station 160101010105	Bear River	344	brook	nd	97	nd	3	nd	1.09	New sample	Believed Flat
		344	cutthroat	nd	72	nd	4	nd	.88	New sample	Believed Flat
		344	rainbow	nd	32	nd	4	nd	1.15	New sample	Believed Flat
		344	whitefish	nd	283	nd	33	nd	1.04	New sample	Believed Flat
		344	total	nd	484	nd	44	na	na	New sample	Believed Flat



Subwatershed and 6 <sup>th</sup> Field HUC Number	Stream	Survey Site	Fish Species	1994 salmonids per mile	2003 salmonids per mile	1994 Biomass (lb/acre)	2003 Biomass (lb/acre)	1994 Ave. Condition Index	2003 Ave. Condition Index	Comments	Trend
Mill Creek Drainage 160101010201	Mill Creek Lower	345	cutthroat	302	421	14	24	0.98	1.02	Fire burned over upper drainage in 2002, beaver ponds between fire burn area and sample site.	Up
	Mill Creek, Upper	348	cutthroat	86	32	10	5	1.13	0.88	Fire <b>burned</b> over the area in 2002, Major ford use <b>immediately upstream</b>	Down
	Mill Creek, Nork Fork Lower	346	cutthroat	129	116	5	8	0.94	1.06		Flat
	Mill Creek, Nork Fork <b>Upper (Aug1994) (July2003)</b>	347	cutthroat	222	251	10	11	0.96	1.04		Up
	Mill Creek, North Fork <b>Upper (Sept.)</b>	361	cutthroat	nd	286	nd	20	nd	0.91		Up
	Carter Creek	343	cutthroat	nd	268	nd	34	nd	1.05	New sample	Believed Flat

<sup>1</sup> Samples shown under columns for 1994 for the lower section of the Stillwater Fork were taken in 2001. The 1994 sample site was significantly changed because of beaver activity in the area so the site was moved upstream approximately 300 meters.

na = no applicable

nd = no data.

Findings: The review **from** the Forest Plan for the headwaters of the Bear River is identified in Table 2. To fully understand the individual factors the reader should refer to the write-up in the Wasatch-Cache National Forest 2003 Land Management Plan FEIS Appendix B3. Trends identified in these tables were based on the factors identified. Each individual survey site in the headwater of the Bear River and its tributaries are identified in Table 3. Comparisons were made between the **1994** and the 2003 fish information. These comparisons included salmonids per mile, biomass in pounds per acre and average condition indexes for fish over 100 mm by species. A comment section is used to identify major events or information that may influence the information interpretation. A trend is also identified using Table 4 for each species by each survey reach, To consistently identify a population trend **from** the data collected in 2003 for each species Table 4 was developed.

Populations were assumed to be trending down if the fish per mile was down and the biomass was down. **An** example of this population trend is where 100 fish with a biomass of 10 pounds per acre and an average condition factor of 1.0 would be trending down is the fish per mile were 3 fish with a biomass of **0.3** pounds per acre and any condition factor.

Populations were assumed to be trending flat if the fish per mile were down and yet the biomass and condition factors were up, or if the fish per mile didn't change and the condition factors went up, or where the fish per mile went up and biomass and condition factors went down.

Populations were assumed to be trending up if the fish per mile was up and the biomass or condition factor was up.

Population trends were assumed to be flat for populations where only one a sample had been taken in 2003 and there were no large-scale changes in land management. In this case the East Fork Fire was considered to be a large-scale change.

Table 4. Table to identify population trend based on changes in **fish/mile**, biomass and condition factors

Fish/mile	Biomass	Condition Factor	Trend
Down	Down	Down	Down
Down	Down	Up	Down
Down	Up	Up	Flat
Flat	Down	Up	Flat
Up	Down	Down	Flat
Up	Down	Up	Up
Up	Up	Down	Up
u p	u p	u p	u p

Combining survey section trends for the cutthroat trout population were used to identified cutthroat trout population trends for 6th level **HUCs**. These were then compared with the population trend identified in the Forest Plan for each 6" level **HUC** (Table 5).

Table 5. Risks and threats associated with the Upper Bear River Drainage (**HUC-14040107**) on the **Wasatch-Cache** National Forest with the identified trend.

Subwatershed and 6 <sup>th</sup> Field HUC Number	2003 Forest Plan Trend pre 2003 data collection	1994 to 2003 Data Comparison	Comments
East Fork Bear River 160101010101	Flat	Flat	The 2002 East Fork Fire burned the middle portion of this drainage leaving the headwater unimpacted. In the summer of 2004, after the 2003 sampling, heavy rains below the sample sites on the East Fork caused landslide, killing fish in a portion of the <b>mainstem</b> East Fork. Data collected in the lower <b>mainstem</b> of the East Fork of the Bear River, compared with 1965 data collected at the same location, suggest that cutthroat trout population are remaining flat ( <b>Thompson</b> 2003).
Stillwater Drainage 160101010102	Flat	Flat	The Stillwater Fork Drainage continues to receive heavy recreational fishing <b>pressure</b> low in the drainage. Data collected in the lower <b>mainstem</b> of the Stillwater Fork, compared with 1953 data collected at the same location, suggest that cutthroat trout population are expanding in their downstream distribution, with only sculpin being collected in the earlier sample ( <b>Thompson</b> 2003). Demand <b>from</b> local <b>anglers</b> has caused the Utah Division of Wildlife Resource ( <b>UDWR</b> ) to resume stocking of rainbow trout low in the <b>drainage</b> .
Hayden Fork 160101010103	Down	Flat	The <b>Hayden</b> Fork Drainage continues to receive heavy recreational fishing and <b>dispersed</b> camping <b>throughout</b> the drainage. Data collected in the lower <b>mainstem</b> of the <b>Hayden</b> Fork, compared with 1953 and <b>1970</b> data collected at the same location, suggest that cutthroat trout population are expanding in their downstream distribution, with only sculpin, mountain sucker and leatherside chub being collected in 1953 and rainbow trout recorded in the <b>1970</b> sample ( <b>Thompson</b> 2003).
West Fork Bear River, Meadow, Humpy, Deer C 160101010104	Flat	Flat	The West Fork Bear River continues to see <b>high</b> recreational use around <b>Whitney</b> Reservoir. Demand for a <b>recreational</b> fishery is high. Data collected in the lower <b>mainstem</b> of the West Fork of the Bear River, off Forest, compared with <b>1964, 1971, 1985</b> and 2003 data collected at the same location, suggest that cutthroat trout population are increased through <b>1985</b> and dropped in 2003 ( <b>Thompson</b> 2003). Differences in sampling methods may also have influenced this data. In 2003 brook trout were also collected for the <b>first</b> time. This corresponding to what was found in the Forest Service collections upstream.
Lower Part near Guard Station 160101010105	Down	Flat	The <b>mainstem</b> Bear River was sampled for the first time on Forest in 2003. The Flat trend is based on the expansion of cutthroat trout in the Stillwater Fork and the <b>Hayden</b> Fork as identified above.
Mill Creek Drainage 160101010201	Flat	Flat	Mill Creek was sampled previously by <b>UDWR</b> in 1954, 1973 and 2003 ( <b>Thompson</b> 2003). The 1954 and 1973 samples were taken at about the Forest Boundary, which is close to the lower sample location of the Forest <b>Service</b> . Cutthroat trout <b>appear</b> to be increasing in this section with a density estimate in 1954 of <b>40</b> fish per mile, in 1973 of <b>380</b> fish per mile and the Forest <b>Service</b> estimate in 1994 of <b>302</b> fish per mile and in 2003 of <b>421</b> fish per mile. The upper section showed a decrease in population, therefore the trend is left flat because of the impacts of the 2002 East Fork Fire in the upper part of this watershed.

### Literature Cited

Cowley, PK. 1995. Fish surveys on the Wasatch-Cache National Forest. Uinta and Wasatch Cache National Forest. Salt Lake City, Utah

Cowley, PK. 2003. Fish surveys on the Wasatch-Cache National Forest during 2003. Wasatch Cache National Forest. Salt Lake City, Utah

Thompson, P. Native cutthroat trout (*Oncorhynchus clarki* spp.) Conservation Activities in the Northern Region, 2003. Utah Division of Wildlife Resources, Salt Lake City, Utah